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B. T. GALLOWAY, Chief of Bureau.

THE WORK OF THE SAN ANTONIO EXPERIMENT FARM IN 1908.

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THE WORK OF THE SAN ANTONIO EXPERIMENT FARM IN 1908.[a]

INTRODUCTION.

Something more than a hundred years ago San Antonio was the center of a little Spanish agricultural community that depended for its existence upon irrigation by diversion from the San Antonio River and some of its tributaries. In the early part of the last century this agriculture sank into insignificance compared with the development of the live-stock industry on the surrounding prairies, which became the interest of paramount importance. Within recent years this old irrigation has almost entirely disappeared, having been replaced by irrigation from artesian wells, while advancing settlement and reforestation of the prairies have practically ended the régime of the cattleman on the open range.

It is only in comparatively recent years that there has been any extensive agriculture without irrigation. The increasing scarcity of farm land to the eastward, together with the need of forage and grain crops to supply the local markets, has forced attention to the possibilities of general farming. As a result there is now a very considerable agriculture without irrigation in the vicinity of San Antonio, and the region to the south and west is also settling up rapidly.

Cotton and sorghum have proved fairly well adapted to withstand the periods of drought that so frequently occur during the growing season, and these constitute the most important money crops of the "dry farmers." Winter cereals grown for hay and a little corn are also produced. All crops are subject to great fluctuations in yield according to the season, and it can hardly be claimed that agriculture without irrigation is yet on a firm basis, even though the annual rainfall exceeds that of a large part of the upper Mississippi Valley, where agriculture is well established.

[a] Last year a report was issued outlining the work carried on at the San Antonio Experiment Farm in 1907 (Circular No. 13, Bureau of Plant Industry), and a brief statement of the work planned for the following years was given. It is the aim in the present circular to supplement the previous one by giving some data on the climate and soils of the San Antonio region and a statement of the more important results obtained on the experiment farm in 1908.—B. T. Galloway, *Chief of Bureau.*

There seems good reason for believing that a substantial and profitable agriculture may be developed in this section if the best methods of tillage and rotation are used, together with the crops best suited to the local conditions.

THE CLIMATE OF SAN ANTONIO, TEX.

The average annual rainfall calculated from the records of the Weather Bureau, beginning with the year 1878, is 28.1 inches, which is about the same as at Lincoln, Nebr., or St. Paul, Minn., but because of the irregularity of its occurrence, the compact character of the soil, which causes a large loss in surface run-off, and the higher evaporation of the region the effectiveness of the rainfall is lessened, making the country semiarid rather than semihumid, as at Lincoln and St. Paul.

The summers are hot and with a rather dry atmosphere, which results in rapid evaporation of moisture from the soil surface and from the leaves of plants. The winters are in the main mild and pleasant, but the rather frequent occurrence of the "northers" during this season often results in hard freezes.

Table I gives the absolute minimum temperatures and the dates of the first and last killing frosts for each year since 1892. The lowest temperature recorded in this period was 4° F. in February, 1899, and killing frosts have been known to occur as late as April, although in the majority of cases the last one was in the month of February. The sudden changes to low temperature often cause great injury to fruit trees which have been started into growth during the warm, pleasant days of winter. For these reasons it is unsafe to grow fruit trees except those hardy enough to withstand a moderate degree of freezing or those that will remain dormant throughout the warmest days of winter or early spring.

TABLE I.—*Dates of killing frosts and absolute minimum temperatures at San Antonio, Tex., from 1892 to 1908, inclusive.*

[Compiled from the records of the United States Weather Bureau.]

Year.	Last spring frost.	First autumn frost.	Absolute minimum for the year.	Year.	Last spring frost.	First autumn frost.	Absolute minimum for the year.
			°F.				°F.
1892	Mar. 19	Nov. 18	19	1901	Mar. 6	Dec. 10	15
1893	Feb. 8	Nov. 24	26	1902	Feb. 16	Dec. 16	26
1894	Mar. 26	Nov. 20	16	1903	Feb. 18	Nov. 18	19
1895	Feb. 27	Nov. 27	11	1904	Feb. 12	Nov. 12	22
1896	Feb. 15	Nov. 28	27	1905	Feb. 21	Dec. 4	13
1897	Feb. 1	Dec. 3	18	1906	Feb. 6	Nov. 20	24
1898	Jan. 16	Nov. 22	20	1907	Feb. 8	Nov. 11	28
1899	Feb. 6	Dec. 4	4	1908	Feb. 20	Nov. 14	22
1900	Apr. 12	Nov. 12	19				

Table III gives the data as to rainfall and evaporation for 1907 and 1908, from measurements taken at the San Antonio Experiment Farm. The measurements of evaporation were obtained from a galvanized-iron tank, 8 feet in diameter and 2 feet deep. This tank is embedded in the soil to a depth of 18 inches. The water in the tank is kept about 18 inches deep and the evaporation is measured daily.

By comparing Tables III and IV it will be noted that the rainfall at the experiment farm for the years 1907 and 1908 was 25.68 and 26.80 inches, respectively, while in the city of San Antonio it was 27.77 inches in 1907 and 28.52 inches in 1908. The rainfall in this section is often extremely local in its character. A heavy rain may occur at one point, while at a distance of 4 or 5 miles none falls. This fact accounts for the frequent discrepancies between the rainfall records of the Weather Bureau in San Antonio and those at the experiment farm, although the rain gauges are but 6 miles apart.

Although the total annual rainfall for 1907 was very nearly the same as in 1908 the crop yields of the two years were widely different, as will be seen by comparing the yields given below. These yields are the averages for corn, cotton, and sorghum grown on the rotation plats on the experiment farm.

TABLE II.— *Yields of corn, cotton, and sorghum on the San Antonio Experiment Farm in 1907 and 1908.*

Crop.	Yields.	
	1907.	1908.
Corn.....bushels..	17.5	27.35
Seed cotton.....pounds..	377	1,096
Sorghum grown for forage.....tons..	3.1	11

The low yields for 1907 may be accounted for by the fact that there was little rain in the fall and winter of 1906–7, so that at seeding time in the spring of 1907 sufficient moisture had not been accumulated to give the crops a vigorous start. On the other hand, in the fall of 1907 heavy rains fell in October and November that came too late to benefit the crops of that year, but they stored up a large supply of moisture that gave quick germination and rapid growth in the spring of 1908, and the heavy and timely rains in May of that year brought the corn to maturity and greatly benefited other crops. The point is here emphasized that the amount of seasonal rainfall is only partially indicative of the crop yields for the same season.

TABLE III.—*Rainfall and evaporation at the San Antonio Experiment Farm in 1907 and 1908.*

Month.	Rainfall.		Evaporation.	
	1907.	1908.	1907.	1908.
	Inches.	*Inches.*	*Inches.*	*Inches.*
January	0.56	0.47	3.28	2.57
February	1.72	2.61	2.80	2.46
March	1.70	1.27	5.58	3.31
April	4.50	2.39	5.65	5.40
May	2.81	5.44	4.91	7.01
June	.31	.88	8.36	8.77
July	2.65	1.37	8.61	8.23
August	.39	3.79	9.44	7.25
September	.64	2.59	6.21	6.11
October	2.98	1.62	4.28	5.28
November	6.78	2.87	2.35	3.26
December	.64	1.50	2.01	2.81
Total	25.68	26.80	63.48	62.46
Monthly mean	2.14	2.23	5.29	5.21

Table IV gives the rainfall for each month in the year for eighteen years, beginning with 1891. It will be noted that the monthly rainfall from April to September, inclusive, averages over 2 inches and that in the remaining months from October to March it averages less than 2 inches. If the rainfall each month would regularly approach the mean rainfall for that month, as given in the table, there would be no reason why fair crops should not be raised every year, but the rainfall during the year is so unevenly distributed that the yield of crops for each season is exceedingly variable.

Previous to May, 1901, there were five months and previous to April, 1902, there were six months of drought. The year 1893 was a year of low precipitation, but the distribution was of such a nature as to be favorable to spring crops.

TABLE IV.—*Monthly precipitation at San Antonio, Tex., for the years 1891 to 1908, inclusive.*

[Compiled from records of the United States Weather Bureau.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
	Inches.	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*	*Inches.*
1891	5.63	1.38	1.18	4.57	2.36	2.16	0.85	1.06	3.60	0.60	0.92	5.73	30.04
1892	1.51	.71	1.75	.16	.89	3.83	.05	9.09	1.09	1.48	1.09	4.16	25.81
1893	.11	1.11	2.14	2.18	3.36	1.90	.96	.92	.10	.08	4.62	.76	18.24
1894	1.42	.52	.80	2.65	1.71	3.09	.60	8.55	1.48	.89	* T.	.04	21.75
1895	1.24	3.97	2.24	.29	6.66	2.09	1.07	1.90	1.25	1.43	3.38	.55	26.07
1896	2.90	2.36	.66	2.73	2.74	.61	2.69	2.96	8.87	6.04	.79	.74	34.09
1897	1.55	.15	1.65	1.84	3.13	2.19	.28	.40	1.61	1.35	.43	1.34	15.92
1898	.46	1.16	1.47	1.46	1.06	7.06	2.24	3.35	1.32	.03	1.34	1.54	22.49
1899	.38	.31	* T.	2.60	2.22	4.32	2.85	.00	.57	1.31	1.70	3.39	19.65
1900	5.42	.34	4.35	9.11	4.47	.78	2.24	4.05	.97	2.94	1.82	.70	37.19
1901	.41	.71	.54	.59	2.47	1.86	3.79	.96	4.20	.12	.64	.15	16.44
1902	.70	.55	.12	2.31	3.14	.02	3.85	.00	5.52	2.54	3.53	2.51	24.79
1903	2.39	7.88	1.29	1.74	1.95	4.75	7.52	.20	2.96	1.61	* T.	.82	33.11
1904	.30	.64	.16	3.25	5.93	1.73	3.50	1.97	7.74	2.86	.24	1.06	29.38
1905	.88	1.62	2.74	6.08	4.11	6.01	2.82	.51	1.80	1.83	2.63	1.56	32.59
1906	.29	1.07	1.29	3.94	.86	.62	4.34	2.25	1.74	1.09	1.33	1.60	20.42
1907	.80	.78	1.88	3.77	4.64	.18	2.68	.80	1.11	3.54	6.79	.80	27.77
1908	1.01	2.42	1.31	2.87	6.07	.30	.66	4.27	3.92	1.47	2.61	1.61	28.72
Mean.	1.52	1.54	1.42	2.90	3.21	2.42	2.39	2.40	2.77	1.73	1.88	1.61	25.79

* T=Trace.

SOIL CONDITIONS OF THE REGION.

San Antonio lies in the southern extension of what is known as the "Black Prairie Region," or the "Black Lands" of Texas, and near the northern edge of an area known geologically as the "Rio Grande Plain." The soil is mostly the result of the weathering of limestone rocks of the Upper Cretaceous period. There have been recent alluvial deposits washed down from the higher lands northwest of the city, resulting in local modifications, chiefly through the addition of coarser material. The typical soil is a heavy black or brownish clay or clay loam.

The region around San Antonio has been made the subject of a soil survey by the Bureau of Soils[a] and twelve soil types have been recognized, of which five are different kinds of clay amounting to 40 per cent of the area, two are clay loam amounting to 27 per cent, three are sandy or silt loam amounting to 20 per cent, and two are sand amounting to 13 per cent.

Analyses made in connection with this soil survey show instances where calcium carbonate constitutes more than half the total soil mass.

TABLE V.—*Percentages of lime (calcium carbonate) in soils in the vicinity of San Antonio, Tex., having an unusually large lime content.*

Soil type.	Depth of sample.	$CaCO_3$.
	Inches.	*Per cent.*
Austin fine sandy loam	0–12	47.0
Do	12–40	52.0
Austin clay	0–18	59.8
Do	18–40	73.4
Do	0–18	62.4
Do	18–36	63.1

This lime occurs in the soil both as finely divided material and as gravelly concretions. In the former condition it is generally dark colored through staining by decomposed organic matter, while in the latter condition it is usually white. The concretions are concentrically laminated and are often cemented together by finer material, in which condition the soil is almost impervious both to water and to plant roots.

On the San Antonio Experiment Farm there is a considerable variation both in the chemical composition and the mechanical structure of the soils. At the south end of the farm only a trace of lime is found in the upper 12 inches of soil, while at the north end, where there is a slightly higher percentage of clay, the amount of lime in the first foot varies from 7 to 23 per cent. One of the "white spots," which are found so commonly in the black lands of this section, was found to

[a] Soil Survey of the San Antonio Area, Texas, Field Operations, Bureau of Soils, 1904.

contain 22.8 per cent of calcium carbonate in the surface foot, while the adjoining black soil contained only 7 per cent. Other analyses gave different degrees of variation between these extremes.

Table VI presents the results of mechanical analyses of three soil types on the San Antonio Experiment Farm. The "light spot" on field B 5, where the first sample was taken, is one of the typical light-colored spots just mentioned. The sample of dark soil is representative of the common black waxy soil of the section and was the soil that surrounded the light spot. This sample was taken but a few rods from the first one. By referring to the table it will be noted that the light spot contains a very much higher percentage of lime, both in the first and second foot, than the dark soil, and it also contains less organic matter. Analyses made by Dr. L. J. Briggs of the surface foot of these two borings showed percentages of organic matter as follows: Light soil, 1.42 per cent; dark soil, 2.76 per cent.

The samples of soil taken from field AB 8, near the south end of the farm, showed only a trace of lime in the surface foot. While the mechanical analysis shows about the same proportions of sand and clay in this sample as in the samples from field B 5, for some reason this soil is much more easily tilled and tools scour in it with greater ease. Locally, it is known as "sandy" soil, in distinction from the black gumbo, although the analysis shows little difference. Experiments have not yet been made to ascertain the relative productiveness of this type of soil as compared with the soil that is richer in lime. This diversity in the lime content and of organic matter is probably associated with the irregular growth so often noticed in fields of sorghum, corn, and horticultural and other crops.

TABLE VI.—*Results of mechanical analyses made by the Bureau of Soils of samples of soil from the San Antonio Experiment Farm.*

Number of field.	Character of soil.	Depth.	$CaCO_3$.	Fine gravel.	Coarse sand.	Medium sand.	Fine sand.	Very fine sand.	Silt.	Clay.
		Feet.	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*	*P. ct.*
B 5	Light spot	1	22.8	0.5	1.8	2.4	23.6	11.3	41.7	18.2
B 5	Dark soil	1	7.0	.1	1.2	1.3	19.7	10.2	47.3	20.6
AB 8		1	Trace.	.0	.2	.8	26.6	26.4	25.3	20.1
B 5	Light spot	2	23.1	.4	1.6	2.2	23.2	9.2	39.5	23.4
B 5	Dark soil	2	11.4	.1	.9	1.3	17.7	11.1	45.2	23.6
AB 8		2	8.9	.1	.4	.6	21.2	24.5	28.1	25.6

THE SAN ANTONIO EXPERIMENT FARM.

EQUIPMENT.

The San Antonio Experiment Farm lies about 2½ miles south of the city limits of San Antonio, Tex., on the Corpus Christi road. It includes 125 acres of land, of which about 100 acres are now under cultivation. The farm is a part of a tract of land belonging to the

city of San Antonio and was formerly under irrigation by the use of the city's sewage. Some years since another means of sewage disposal was provided and the use of this tract as a sewer farm was abandoned.

The farm has been improved by the erection of a dwelling house, a barn, a seed house and office, a greenhouse, and a large implement shed, funds having been provided by a popular subscription through the Business Men's Club of San Antonio.

The working force consists of a superintendent, an office assistant, a man with special horticultural training, and several farm laborers. The farm is well equipped with farm machinery, special attention

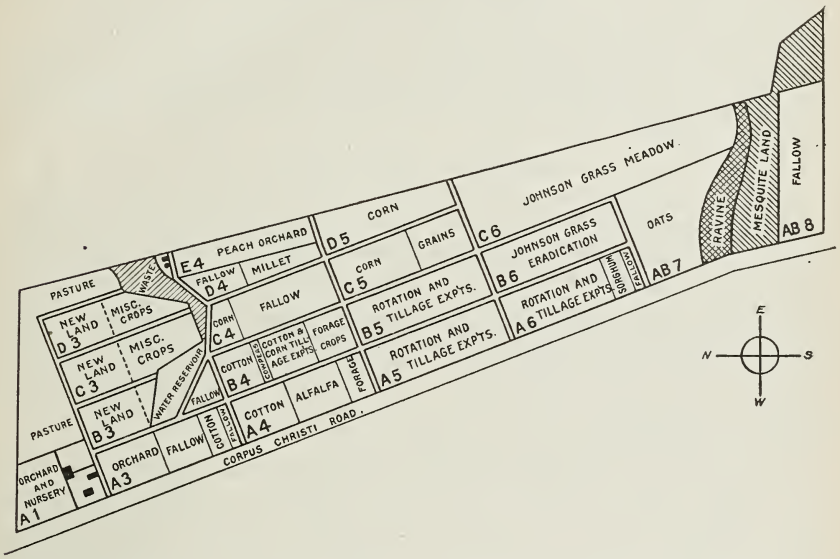

FIG. 1.—Sketch showing the location of fields, crops, etc., on the San Antonio Experiment Farm.

having been given to securing types of cultivators and other machinery useful in conserving soil moisture. The sketch of the farm (fig. 1) shows the present arrangement of the fields and roads and also the crops on the fields in 1908.

LINES OF WORK UNDERTAKEN.

Cooperative work with offices in the Bureau of Plant Industry is being carried on as follows: The acclimatization of Central American types of corn and cotton, with O. F. Cook and G. N. Collins, of the Office of Bionomic Investigations; tests of varieties of forage crops, with C. V. Piper, of the Office of Forage Crop Investigations; tests of varieties of grains, with M. A. Carleton, of the Office of Grain Investigations; tests of plant immigrants and horticultural crops, with

David Fairchild, of the Office of Foreign Seed and Plant Introduction, and William A. Taylor, of the Office of Field Investigations in Pomology; life history studies of the pistache, citrus fruits, and alfalfa, with W. T. Swingle and Charles J. Brand, of the Office of Plant Life History Investigations; trials of olive and pomegranate varieties, with T. H. Kearney, of the Office of Alkali and Drought Resistant Plant Breeding Investigations; and tests of native corn varieties, with C. P. Hartley, of the Office of Corn Investigations.

The results of these cooperative investigations that are not published in the annual reports of the farm work will be published from time to time by the cooperators and will appear as special reports dealing with the San Antonio region or as more general reports.

In addition to the cooperative work mentioned the following general lines of investigations have been carried on: Tillage experiments with corn and cotton, eradication of Johnson grass, and certain soil-moisture studies.

EXPERIMENTS WITH CEREALS.

Grain crops have not been commonly raised other than for forage purposes in the region about San Antonio. Wheat, oats, barley, and rye do not ordinarily yield well. This failure to set seed seems to be due chiefly to the prevalence of fungous diseases and insects. Rust appears early in the spring before the grains have headed out and weakens them very materially. Work is being continued with a number of varieties of cereals for the purpose of studying these rusts and other diseases.

On November 8, 1907, there were planted on the experiment farm in one-fifth-acre plats three varieties of wheat, four varieties of oats, and a variety of rye. The rate of seeding for wheat was 60 pounds and for oats 55 pounds per acre. Rust attacked the wheat about the middle of March and so sapped the vigor of the crop that very low yields resulted, as shown by the table below:

TABLE VII.— *Yields of varieties of cereals at the San Antonio Experiment Farm in 1908.*

Variety.	Yield per acre.		Variety.	Yield per acre.	
	Grain.	Straw.		Grain.	Straw.
	Bushels.	*Pounds.*		*Bushels.*	*Pounds.*
Boswell Winter oats	0.0	0	Abruzzi's rye	17.6	3,630
Culberson Winter oats	21.3	4,170	Rieti wheat	7.0	2,160
Red Algerian oats	24.5	4,800	Fretes wheat	2.3	1,575
Appler's Rustproof oats	37.7	4,720	Galgalos wheat	3.0	1,300

The varieties of oats tried were Boswell Winter, Culberson Winter, Red Algerian, and Appler Rustproof. The Boswell oats were so seriously injured by rust that no grain was produced.

The straw of the Red Algerian and the Appler oats was so weak as to cause these varieties to lodge badly, so that they had to be cut by hand. The straw of the Culberson oats, however, was very stiff and the entire crop stood up well, giving this variety considerable advantage over the other two, although it did not yield so well.

In addition to the above regular variety tests twenty-one 0.1-acre rotation plats were planted to Texas Red Rustproof oats at the rate of 42 pounds per acre, which gave an average yield of 17.7 bushels per acre, while three 0.1-acre rotation plats were planted to Galgalos wheat, giving an average yield of 3.6 bushels.

EXPERIMENTS WITH CORN.

In cooperation with the Office of Corn Investigations an extensive test of corn varieties was made. The varieties under trial were collected from the best that has appeared in the corn exhibits throughout the State of Texas. Among the 63 strains that were tested, some very high yielding ones that seem well adapted to this section were found. One-twentieth acre of each variety was planted on February 28 on land that had been in cotton the previous year. The yields varied from 20 to 64 bushels per acre, the variety known as Laguna being the most productive.

In addition to the variety tests mentioned, seed of five varieties was obtained from Sherman, Tex., for trial. Table VIII gives the areas planted and yields obtained.

TABLE VIII.—*Areas planted to five varieties of corn at the San Antonio Experiment Farm in 1908, with yields obtained.*

Variety.	Area of plat.	Yield per acre.
	Acre.	*Bushels.*
Chisholm	0.61	51.5
Sure Cropper	.55	42.5
Ferguson's Texas Gourd	.60	42.1
Ferguson's Yellow Dent	.98	36.2
Boone County White	.72	25.7

These results were obtained by weighing the corn after it was husked, estimating 70 pounds of corn on the cob to a bushel of shelled corn.

White Wonder corn was planted on 26 rotation plats on fields A 5 and B 5, and an average yield of 25.3 bushels per acre was obtained.

In field A 6 six plats of corn on land which had grown millet the previous year yielded at the rate of 32.9 bushels per acre, while four plats that had been in oats the previous year yielded only 13.5 bushels per acre. The decreased yield of the corn on the oat land was probably due chiefly to the action of cutworms, which reduced the stand of corn plats fully 50 per cent.

EXPERIMENTS WITH FORAGE CROPS.

Sorghum is one of the surest and most remunerative forage crops in the vicinity of San Antonio. It is highly drought resistant, and when planted in rows and cultivated will make a fair crop of hay even in the driest seasons.

When sorghum is planted thickly in drilled rows and kept well cultivated during the summer very much better forage yields are obtained than when sown broadcast, especially during the drier seasons. The sorghum hay that has been produced from cultivated rows is somewhat coarser than when broadcasted, but the greater yields obtained from row planting, particularly in dry seasons, more than compensate for the slightly decreased market value.

Sumac and Red Amber sorghums proved to be the best yielding varieties tried. Although the Sumac variety gave but two cuttings and Red Amber three cuttings, the former variety produced the greater quantity of forage per acre. For three successive years Sumac has been the best yielding variety on the experiment farm. Its stalk is coarser than that of the Amber sorghum, but is very sweet and juicy. In the rotation plats the Sumac variety yielded 13 tons to the acre and Red Amber 7 tons, from three cuttings.

Table IX shows the forage yields of two plantings of sorghum varieties. It will be noted that the yield was considerably reduced by late planting.

TABLE IX.— *Yield of varieties of sorghum grown in one-tenth-acre plats at the San Antonio Experiment Farm in 1908.*

S. P. I. number.	Variety.	Planting I.			Planting II.		
		Date planted.	Number of cuttings.	Yield.	Date planted.	Number of cuttings.	Yield.
				Tons.			*Tons.*
17554	Sumac	Mar. 30	2	12.29	Apr. 23	2	6.3
17548	Red Amber	...do	3	10.17	...do	2	4.29
17556	Orange	Mar. 18	2	7.12	...do	2	5.36
17539	Planter's Friend	...do	2	6.00	...do	2	5.49
20799	Minnesota Amber	...do	3	5.38	...do	2	3.22
17569	Kafir	...do	2	4.83	...do	2	3.84
18684	Dwarf Milo	...do	2	4.38	...do	2	4.74

Millet grows well in seasons having at least an average amount of rainfall and should prove to be a very useful crop in the farm rotations. Those varieties that mature in from forty to fifty days might follow the winter oat crop when the May and June rainfall permits, thus securing two hay crops from the field in one season. After the corn crop is removed in July advantage might occasionally be taken of favorable rains in August or early September to grow a late crop of millet.

A large number of varieties were given a preliminary trial in 1908, as shown in Table X. The Kutki variety produced the greatest yield, but it is so slow in maturing that it can hardly be considered a desirable variety as a catch crop. The best variety when both yield and quickness of growth are considered seems to be the German. German millet is a well-known variety in this country and seed can be obtained from commercial seed sources.

The varieties listed in the following table were planted in one-tenth-acre plats in May, 1908. The land on which they were planted was fallow throughout the year 1907.

TABLE X.—*Number of days necessary to mature several varieties of millets grown at the San Antonio Experiment Farm in 1908, with yield of hay.*

S. P. I. number.	Variety.	Days to mature.	Yield per acre.
			Tons.
21533	Kutki (*Panicum psilipodium*)	108	2.50
21287	Shama (*Panicum colonum*)	76	1.93
22340	German (*Chaetochloa italica*)	52	1.70
22425	German (*Chaetochloa italica*)	52	1.65
21601	Sanwa (*Panicum frumentaceum*)	122	1.60
22423	Common (*Chaetochloa italica*)	48	1.57
22420	Kursk (*Chaetochloa italica*)	40	1.56
22426	Hungarian (*Chaetochloa italica*)	43	1.50
22427	Japanese (*Panicum frumentaceum*)	45	1.34
22424	Siberian (*Chaetochloa italica*)	43	1.25
22570	Billion Dollar grass (*Panicum frumentaceum*)	47	1.09
21074	Broom-corn millet (*Panicum miliaceum*)	45	.25
22422	Broom-corn millet (*Panicum miliaceum*)	40	.25

Twenty-three other varieties of millet were tested in rod rows. The best of these are being grown again in large plats where comparative yields can be obtained.

A number of varieties of clover have been tried during the past two years, but none so far have given much promise of value. One variety of crimson clover (S. P. I. No. 18420) gave a yield of 1,240 pounds of hay per acre, based on the results from a one-twentieth-acre plat.

Cowpeas were grown on the rotation plats following corn and oats, to be plowed under for green manure. Forage yields were not obtained, but the crop made a rank growth and would have yielded a fair crop of hay.

Bonavist beans made a very favorable showing. The hay yield from these beans was at the rate of 2,560 pounds per acre.

A variety of Canada peas was planted in the fall of 1907, and gave promise of being a very valuable winter crop. The vines grew to a length of 6 feet or more, but as the crop was left to mature in order to obtain the seed the forage yield was not obtained.

A plat of Spanish peanuts, one-twentieth acre, yielded at the rate of 19½ bushels per acre. The peanuts were somewhat smaller than

the original seed from which they were grown, and in a considerable number of cases the nuts were not properly filled out. Peanuts are not likely to prove profitable, at least on the heavy black type of soil.

MEXICAN SEEDLING PEACHES.

In February, 1905, at the suggestion of Mr. William A. Taylor, there were sent to the farm about 500 seedling peach trees that had been grown by Mr. G. L. Tabor, of the Glen Saint Mary nurseries in Florida, from seeds collected by Mr. G. Onderdonk, of Nursery, Tex., in the dry-land fruit regions of Mexico. As Mr. Onderdonk himself states:

> The object in getting these peaches was to secure for the Texas-Gulf region, which is too far south for the North China type and too far north for the South China type of peach, by selection from seedlings of Spanish stock in Mexico, a type which would fit conditions as they exist.[a]

These were set out temporarily in field A 1 and in January, 1906, were removed to field D 3. They came into bearing in 1908 and Mr. Onderdonk was secured as an expert to go through the orchard and select the individual trees that gave promise of being worthy of further trial. In the orchard there was found to be great diversity in the character of the fruit and the time of ripening. Peaches began maturing on June 20 and continued until October. Several of the trees seem to be promising, and there are many others that are to be passed upon during the coming season. Especially interesting were two trees of the Spanish type bearing a very superior quality of fruit and one tree of the Chinese Honey type heavily loaded with fruit, fully equal to that variety from which all of our South China varieties are descended.

All the trees marked "undesirable" by Mr. Onderdonk have been taken out in order that those remaining may have a better opportunity for growth. Several thousand seeds obtained from the fruit crop of 1908 have been planted in order to obtain stocks on which to bud from the more promising trees in the orchard.

These Mexican seedling peaches seem to be on the whole better adapted to San Antonio conditions than the commercial varieties generally planted there. This is particularly true as regards their ability to resist the yellowing of the leaves that is probably induced by the excess of lime in the soil. If they continue this resistance as they grow older they may prove to be of value as stocks for the ordinary varieties, even if they yield no new varieties of value. Another point of advantage which seems to be possessed by these seedlings is that they remained dormant throughout the winter of 1907–8, while

[a] Mr. Onderdonk's expedition to Mexico was made under the direction of the Office of Seed and Plant Introduction and Distribution of this Bureau. The peaches were distributed under S. P. I. numbers 9320 and 9321.

most of the standard varieties blossomed before the last spring frost, which occurred February 20, and as a result failed to set fruit.

The Mexican seedling orchard seems to be badly infested with a disease of the roots known as "crown-gall," or "root-gall." Notes were taken on the condition of the roots of the undesirable trees removed. Of the 178 taken up, 98 were apparently in good condition, 35 were badly affected with crown-gall, 41 slightly affected with crown-gall, 3 dead from root-rot, and 1 infested with nematodes.

Crown-gall is one of the diseases prevalent in the orchards about San Antonio. It is easily identified by the irregularly shaped knots appearing on the roots or on the trunk of the tree at or just below the surface of the ground. After the trees are planted nothing can be done to check its advance. Preventive measures can be used by growing seedlings in soil that is known to be free from crown-gall. Then, before transplanting, the roots of all trees should be carefully inspected and all that show any signs of having root-gall, or crown-gall, should be discarded.

TILLAGE EXPERIMENTS.

The tillage experiments outlined in the previous report upon the San Antonio Experiment Farm[a] were continued in 1908, including an experiment to compare the drilling and check-rowing of corn and cotton. The following results were obtained:

Checked rows, 4.1 feet each way, 31.9 bushels for corn and 937 pounds per acre for cotton.

Drilled rows, 4.1 feet apart, 31.1 bushels for corn and 1,040 pounds per acre for cotton.

Drilled rows, 5.5 feet apart, 850 pounds per acre for cotton.

Check-rowed cotton yielded less both in 1907 and 1908 than drilled cotton, while check-rowed corn yielded slightly more each year. Although the results of the two years are in accord, the differences are too small to be significant. Check-rowed fields have the advantage that they can be kept cleaner by cultivation than drilled fields, and it is believed in the case of cotton that more boll weevils are destroyed by the heat of the sun when the cotton is planted in checks than when it is drilled.

The early planting of cotton compared with late planting.—In 1906 and again in 1908 tests were made to determine the time of planting most favorable to securing the best yields of cotton. The results indicate that too early plantings may result in lessened yields due to the checking of the growth of the young plants by cold. Cold weather occurring after the cotton has germinated lessens the vigor and consequently the yield of the crop. It is to be expected that the best time for planting will vary considerably from year to year, according to the character of the season. In 1906 the best yield was obtained

[a] Circular No. 13, Bureau of Plant Industry.

from a planting made on March 23, and in 1908 the best yield was from a planting of April 25. Table XI gives the results of the two seasons' experiments.

TABLE XI.—*Results of tests to determine the best time to plant cotton, made at the San Antonio Experiment Farm in 1906 and 1908.*

Date planted.	Yield.	Date planted.	Yield.
1906.	*Pounds.*	1908.	*Pounds.*
March 8	1,109	March 14	1,040
March 23	1,220	March 27	1,099
April 7	1,190	April 25	1,142
April 23	760		
May 7	546		

These results are not sufficiently adequate to be conclusive, but they indicate that the very early planting, sometimes practiced in an endeavor to avoid the ravages of the boll weevil, may not be advisable from the standpoint of crop production, even in regions infested by the boll weevil.

THE ERADICATION OF JOHNSON GRASS.

In the previous report on the work of the San Antonio Experiment Farm it was stated that the cost of eradicating Johnson grass from a 4-acre field on which oats were grown in the winter of 1906–7 was only $1.25 per acre for extra cultivation after the oats were removed and the land was plowed. Another case was reported in the same paper of the eradication of Johnson grass from a 2-acre field that had been fallowed during the winter of 1906–7, sown to millet in the spring, and then fallowed for the remainder of the summer after the removal of the millet. This treatment cost $10.84 per acre for early spring and late summer cultivation to eradicate the grass.

An additional instance showing the cost of eradication can now be given: A 5-acre field of Johnson grass meadow that had been plowed shallow in the fall of 1907 was kept fallow throughout 1908 by cultivation with sweeps attached to a two-horse riding cultivator and by the hand hoeing of spots not taken out by the cultivator. The cost of this work, not including the cost of plowing in 1907, was $12.60 per acre. The increased cost of eradication in this case was probably due in part to the greater amount of rainfall in 1908 than in 1907. The rainfall from March to October, inclusive, was 16 inches in 1907, while for the same period in 1908 it was nearly 20 inches.

It is evident from these results that in attempting to eradicate Johnson grass it is cheaper and more effective to grow a winter crop of oat hay than by keeping the land fallow throughout the year. When a heavy crop of grain is on the land in winter the soil goes into the summer comparatively dry, which severely checks and weakens the Johnson grass. This same fact applies equally well to isolated spots of Johnson grass in fields of cotton or other crops. It is both expen-

sive and unsatisfactory to try to subdue Johnson grass solely by cultivation. In case of weedy spots in a field it would be better to plow the spot in the fall, sow it to oats for hay, and then, if the following season be dry, clean out the grass by severe tillage or, if wet, follow the oats with millet. Half-hearted cultivation of Johnson grass makes it thrive rather than injures it.

SUMMARY.

Agriculture in the vicinity of San Antonio, Tex., was formerly limited by the irrigation available. This was followed by stock raising on the open range on a large scale and more recently there has been a considerable development of crop production without irrigation by methods of cultivation better adapted to the conditions.

The climate is dry, though the rainfall equals that of the upper Mississippi Valley. The soil is mostly heavy and absorbs the rain slowly, but is fertile and productive under good tillage.

The San Antonio Experiment Farm, which consists of 125 acres of land, is operated by the Bureau of Plant Industry for the purpose of investigating the local agricultural problems.

Yield tests of cereals show that fungous diseases and insect pests make grain production hazardous. The best variety of oats under test yielded 37 bushels per acre.

The season was favorable for corn, and yields of more than 50 bushels per acre were obtained.

Experiments with various forage crops showed that good yields of sorghum and millet may be secured. Sumac sorghum and German millet gave the best results.

A 3-acre orchard of Mexican seedling peaches which has just come into bearing gives promise of furnishing one or two varieties of peaches that will be well suited to San Antonio conditions.

Tests made in planting cotton and corn in drills as compared with planting in check rows showed little difference in yield, while in the case of cotton medium-late planting seems likely to give better results than very early planting.

Further experiments with Johnson grass show that the eradication of this weed by clean cultivation, though quite possible, is more difficult and expensive than when done in connection with the growing of crops that keep down the supply of soil moisture.

Approved:

JAMES WILSON,
Secretary of Agriculture.

WASHINGTON, D. C., *May 21, 1908.*

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